

STATE OF CALIFORNIA
AIR RESOURCES BOARD

AIR MONITORING QUALITY ASSURANCE

VOLUME V

AUDIT PROCEDURES
FOR
AIR QUALITY MONITORING

APPENDIX C

PERFORMANCE AUDIT PROCEDURES
FOR
OZONE ANALYZERS USING A PORTABLE OZONE TRANSFER STANDARD

MONITORING AND LABORATORY DIVISION

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C.1.1 INTRODUCTION

Ozone audits are used to validate ambient air data collected at air monitoring stations. The Quality Assurance Section (QAS) of the California Air Resources Board (CARB) currently employs two methods of conducting ozone performance audits.

In the first method, an Environics 9100S gas calibrator is used as an ozone source and an API 400 ozone analyzer as a transfer standard for auditing the air monitoring station's ozone analyzer (see Volume V, Appendix E). The audit van is driven to the air monitoring station and the audit van's 150 foot gas presentation line is connected to the air monitoring station's inlet probe. The ozone transfer standard is then used to generate a known amount of ozone in the United States Environmental Protection Agency's (U.S. EPA's) required audit ranges. This ozone concentration is then introduced into the station's inlet probe. The response of the air monitoring station's ozone analyzer to this concentration is then compared to the actual ozone levels measured by the API 400 ozone analyzer, and a percent difference is calculated.

In the second method, an API 401 portable ozone transfer standard is transported to the air monitoring site. This procedure addresses that method for ozone determination.

In the event that the Environics 9100 gas calibrator cannot be used as an ozone source and the API 400 ozone analyzer as the transfer standard for the site's ozone analyzer, it will be necessary to conduct the audit using a portable ozone transfer standard. The audit is performed by transporting the portable ozone transfer standard (transfer standard) to the site and connecting it to the ozone analyzer to be audited (host analyzer). The ozone output from the transfer standard is then compared to the results obtained during the audit from the host analyzer. From the analysis of these results, a percent difference is calculated and an audit report issued.

The transfer standards are certified quarterly by the Air Resources Board (ARB) Standards Laboratory using a U.S. EPA verified Primary Photometer.

This procedure addresses the actual set-up and operation of the portable ozone transfer standard.

C.1.2 AUDIT EQUIPMENT

The performance audit, utilizing the API 401 portable ozone transfer standard, requires the following equipment:

1. Currently certified API 401 transfer standard.
2. One five foot section and one twenty foot section of PTFE Teflon tubing complete with 1/4 inch Teflon fittings.
3. Vol-o-flo, 0-10 liters per minute (lpm)
4. Portable ozone transfer standard worksheet.
5. Computer, printer, and related audit software.
6. A multiplug surge protector.

C.1.3 API 401 OZONE TRANSFER STANDARD AUDIT PROCEDURE

1. Connect the API 401 ozone transfer standard to a 110 VAC outlet and allow a minimum of one hour warm-up time before beginning the audit. The transfer standard may be warming up while en route to the audit location.
2. While the transfer standard is warming up, complete the portable ozone transfer standard worksheet (worksheet), Figure C.1.3.2.
3. After one hour warm-up time, connect the transfer standard to the host analyzer in the following manner:
 - a. Disconnect the sample inlet line from the sample inlet port of the host analyzer.
 - b. Connect one end of the five foot Teflon line to the first open port of the “IZS Vent” on the transfer standard. Connect the other end of the five foot line to the sample inlet port of the host analyzer (Figure C.1.3.1).
 - c. Connect one end of the twenty foot Teflon line to the center port of the transfer standard “IZS Vent”. Allow the other end of the twenty foot line to remain unconnected to vent excess flow (Figure C.1.3.1)
 - d. Do not uncap the third port on the transfer standard.
4. Once the set-up is complete, begin the audit by pressing the button located under “ZERO” on the transfer standard. The pump will turn on, and there will be an output flow of five liters per minute (5 lpm). Continue in the following manner:

NOTE: The excess flow can be measured by connecting the open end of the twenty foot Teflon line to the 10 LPM Vol-o-flo. The API 401 generates five liters per minute flow at all times, so the excess flow should be equal to the total flow minus the flow required by the host analyzer.

- a. Allow the zero to stabilize for at least 15 minutes.
- b. After 20 minutes have elapsed, record the zero response for the transfer standard and the host analyzer on the worksheet under Audit Point 1.
- c. Press the button located under “O3GN” (or "CONC" on the 401X model) on the front panel display on the transfer standard. Press the second button from the left until a 4 is displayed. Next, press the third button from the left until a 0 is displayed. Then, press the fourth button until a 0 is displayed. The display should now read 0400. Press “ENTER”.

- d. Allow this point to stabilize. This may take from 15 minutes to one half hour. When the transfer standard and the host analyzer are stable, record their responses on the worksheet under Audit Point 2.

NOTE: While the transfer standard is warming up, complete the Station Instrument Information on the Portable Ozone Transfer Standard Worksheet (worksheet). Figure C.1.4.2
 - e. Press the button under “O3GN” (or "CONC"), and the display should read 0400. Press the corresponding buttons, as in “c” above, until 0175 is displayed. Press “ENTER”.
 - f. Again, allow the transfer standard and the host analyzer to stabilize (from 15 to 30 minutes). After they have both stabilized, record the responses on the worksheet under Audit Point 3.
 - g. Press the button located under “O3GN” (or "CONC") 0175 is still displayed. Press the corresponding buttons, as in “c” above, until 0070 is displayed. Press “ENTER”.
 - h. After the transfer standard and host analyzer have stabilized (15 to 30 minutes), record their responses on the worksheet under Audit Point 4.
 - i. Press the button located under “ZERO” on the transfer standard. After the transfer standard and the host analyzer have stabilized (15 to 30 minutes), record their responses on the worksheet under Audit Point 5.
 - j. Return the host analyzer to the “On Line” condition by disconnecting the five foot line from the host analyzer’s sample port, and reconnecting the sample line.
 - k. Turn off the transfer standard, disconnect the five foot line and the three foot line, and secure the transfer standard in the van.
5. The audit is now complete, and the information can be entered into the computer (refer to Volume V, Appendix E, Section E.1.2.2). Print a preliminary report in two copies (Figure C.1.3.3)



Figure C.1.3.1
Portable Ozone Transfer Standard Set-up

QA AUDIT WORKSHEET PORTABLE OZONE TRANSFER STANDARD

Site Name _____ Date _____

Site Number _____ Auditors _____

Van []
Quarter: 1[] 2[] 3[] 4[] Standards Version _____ Year _____

Ozone Responses					
Audit Point	1	2	3	4	5
Transfer Standard Ozone Setting	0	400	175	70	0
API 401 Display Reading					
Host Analyzer Reading					

STATION INSTRUMENT INFORMATION	
Manufacturer	
Model	
Property Number	
Calibration Date	
EPA Equivalency #	
Slope/Intercept	
Indicated Flow	
In-Line Filter Change	
Cal. Certification Date	

Figure C.1.3.2
Portable Ozone Transfer Standard Worksheet

Technical Appendix - Ozone

Station/Van Audit Data & Results					
Station Data		Van Data	Station Indicated (ppm)	Van Actual (ppm)	Percent Difference
0.001	Pre Zero	0.000			
.396	High Point	.400	.395	.400	-1.3%
.175	Mid Point	.175	.174	.175	-0.6%
.070	Low Point	.070	.069	.070	-1.4%
0.001	Post Zero	0.000			
Audit Calculations					
Certification Equation for API Ozone Analyzer					
Van Actual = (((Van Data -Zero Avg) *O3 Slope + O3 Intercept) * (1- Line Loss/100))					
O3 Slope =		0.99940	Zero Avg =	0.000	
O3 Intercept =		0.00000	Line Loss =	0.000	
Instrument/AIRS Information					
ARB Number	10250	AIRS Number	060190010		
Audit Date	06/25/2002	Instrument Manf.	API		
Version	1	Model	400		
Quarter	2	Serial Number	20004538		
Van	E	Last Calibration	04/24/2002		
General Comments					

* Cal equipment cert date not available.

C.1.4 CERTIFICATION

The ozone transfer standards are submitted to the Standards Laboratory on a quarterly basis for recertification. The transfer standards are certified against a U.S. EPA verified Primary Ozone Photometer. This certification includes a verification that the new certification does not differ by more than $\pm 1.5\%$ from past certification values and that the slope and intercept fall within one standard deviation of the last six certification equations.